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OBSERVATIONS ON THE FEEDING ACTIVITY OF THE ISOPOD, *IDOTHEA BALTICA* (PALLAS)¹⁾

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With Plate X

ABSTRACT³⁾

Observations both in the laboratory and in the field were made on food preference, feeding behavior, rate and amount of feeding in the isopod, *Idothea baltica* (PALLAS). These observations demonstrated that *I. baltica* is an omnivore that feeds readily on both the *Fucus* that harbors it and on both living and dead animals. Values obtained from several experiments showed that, on the average, an individual consumed about one-fifth of its body weight in half an hour when feeding on *Fucus*. When preying on a member of its own species, it consumed approximately more than one-third of its body weight in four hours.

It was demonstrated that the animals fed preferentially on the filiform processes on the surface of the *Fucus* thallus and on the younger and more tender portions of the plant. When feeding on other crustaceans, including individuals of their own species, they attacked living animals of up to one-half of their own length and dead or molting animals of almost their own size. They grasped their prey with the pereopods and usually feeding was initiated on the soft ventral parts. Eventually, the prey, including the exoskeleton, was totally consumed.

Introduction

Early observations have indicated that *Idothea baltica* (Isopoda, Crustacea) is primarily a carnivore species (ROUX, 1829 and COLLINGE, 1917). NAYLOR who has published extensively on the genus, dealt mostly on the morphology and function of the mouthparts and suspected that *I. baltica* is a potential omnivore. The present paper is concerned with certain observations on the feeding habits of this species; its food items and food consumption.

Idothea baltica is a cosmopolitan species found on both American and

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 - 3) Abstract published in the Biological Bulletin, 119 (2): 312, October, 1960.

European coasts; as north as the Scandinavian, as far south as the New Zealand waters, and in the tropical waters of Brazil and Java. They are commonly found on the surface but they have been brought up by dredgings from as deep as 119 fathoms. This species has been collected on floating seaweeds, among algae along rocky shores, and among gravels and rocks at low water (RICHARDSON, 1901 and KUNKEL, 1918) as well as from dredge samples (NAYLOR, 1955). SEGERSTRÅLE (1944) specifically found the species associated with *Fucus vesiculosus* in the Gulf of Finland. Similar condition seems to prevail in the Woods Hole area, northeastern coast of U.S.A., where *I. baltica* appears to be commonly associated with two or more species of *Fucus* collected from the shallow tidal areas of the shore.

I wish to acknowledge the help and advice of Dr. Howard L. SANDERS of the Woods Hole Oceanographic Institution. Thanks are also due to Dr. Eugene P. ODUM of the University of Georgia for preliminary suggestions and to Dr. Hiroya KAWANABE of the University of Kyoto for reviewing the data.

Materials and Methods

Two species of the benthic alga *Fucus vesiculosus* and *F. evanescens* were found to harbor *Idothea baltica*. Since *F. evanescens* was present in great abundance in the studied area, it was used for the laboratory observations. All the specimens of *Fucus* and isopods were collected from Nobska Point, about a mile southeast of the Woods Hole Marine Biological Laboratory, Massachusetts.

In the laboratory, the animals were singly isolated in finger-bowls and beakers containing clean filtered sea water (22°C) obtained from the sea water system of the laboratory. The isopods were tested for food preference by presenting them with both algae and dead animals such as amphipods and isopods. The feeding rate by single specimens of *I. baltica* on clean thalli of *Fucus* was observed. The mode of cannibalism was observed by introducing singly small idoteids into containers with adults previously isolated. Several similar experiments of each case were carried out. This study was conducted during the summer of 1960.

Amount of algae consumed per unit time was estimated by obtaining the dry weight of the bits or pieces of algae obtained from the reconstruction of the damaged portions of the thallus. Estimation was based on continuous feeding which occurred rather rarely and lasted for no more than 30 minutes on two separate occasions. Rate during discontinuous feeding was also noted. The dry weight of animals fed upon was estimated from average weights of several isopods of equal size taken previous to the feeding experiments.

Field observations were carried out in conjunction with the laboratory observations along the rocky beaches of Nobska Point where extensive growth of *Fucus* occurs. Field studies were limited to very short duration due to

difficulty of following the animals. Water movement and animals' agility made such observations practically impossible. Glass-face mask and snorkel were utilized in carrying out field observations.

Results and Discussion

No appreciable amount of preference could be determined when both algal and animal food were introduced. *Idothea* fed readily on both algal and animal sources although there might be a slight preference for animal food.

When *Idothea* fed on *Fucus*, the pronounced cryptostomata (epidermal hairy processes) of *Fucus evanescens* is the preferred portion of the plant. When *Fucus* thalli were introduced, all the experimental animals fed initially on the cryptostomata leaving the surface smoothly cleaned. Only after practically all the available cryptostomata had been consumed did the idoteids then begin to eat the plant tissue proper. The animals chewed on the tips and edges of the algal thallus, tearing the outer epidermis and creating an irregularly shaped excavation of rather smooth contour. Occasionally, feeding was initiated from a central point of the frond thus creating a smooth hole. There seemed to be some difficulty in starting to tear the edge but after this is achieved, the animals would go on gnawing the tissue voraciously. In cases where uncleaned *Fucus* was presented as food, the animals fed on the epiphytes (*Ceramium rubrum* and *Elachistea fucicola*) and on the "Aufwuchs" of the algal frond. The feeding mechanism of the idoteids was described in detail by NAYLOR (1955).

Accurate measurement of feeding rate could not be made since the animals in all cases fed rather discontinuously (30 minutes being the longest continuous feeding time). It was estimated that in half an hour of continuous feeding, *Idothea* consumed almost one-fifth of its body weight. It was also calculated that an amount about equal to one-fourth of the body weight was consumed in twenty four hours of discontinuous feeding (Table 1). The high rate of

Table 1. Estimates of food consumption of *Idothea baltica*.
Two sets of experiments shown.

Food item	Actual time-duration of feeding	Experimental isopods		Food consumed (g dry wt.)	% food consumed per body weight	Calculated % food consumed/body wt./hr.
		Body length (mm)	Body weight (g dry wt.)			
Alga (<i>Fucus</i>)	30 minutes (continuous)	16	0.021	0.0040	19	38
		16	0.021	0.0036	17	34
	24 hours (discontinuous)	16	0.021	0.0050	24	1
		16	0.021	0.0068	32	1.3
Animal (Idoteid)	4 hours (discontinuous)	13	0.019	0.0087	46	11.4
		16	0.023	0.0070	30	7.5

food consumption observed during the 30-minute continuous feeding represents the initial daily feeding, and feeding activity slowed down so that animals merely fed idly the rest of the 24 hours. Figures obtained from the 24-hour experiment represent the normal daily consumption of vegetal food.

Cannibalism does occur in this species, and both living and dead idoteids were eaten. Molting individuals were particularly susceptible as prey. When living small *Idothea* was introduced to test animals that have been previously isolated for one day and fed mainly with *Fucus*, attack on the prey was immediate. Usually a single predator seized its prey either from the dorsal or ventral side. The prey was grasped with the pereopods while the predator continues swimming with the pleopods. The ventral junction between the head and the thorax proper seemed to be a preferred point of attack. When two animals prey on a single victim, one usually seized the prey on its dorsal side while the other attacked from the ventral side. In such cases feeding was remarkably fast; a prey about 7 mm long was devoured by two 15 mm individuals in no more than five minutes, leaving only the exoskeleton which later was totally consumed.

Another feeding behavior pattern was noted when observation on a single individual of about 16 mm length seized a 7 mm prey carrying it around while attacking it on all sides of the body. After about an hour the prey was dead and the body almost severed in two pieces. The feeding *Idothea* released the prey regularly and idly came back to it to feed. One hour later the animal fed on the entrails and laboriously consumed it in 15 minutes. The prey was completely eaten in less than four hours. Feeding on its own cast skin was also observed (NAYLOR, 1955).

As can be seen from Table 1, the isopods consumed approximately more than one-third of its body weight in 4 hours when feeding on animal food.

When two or more idoteids of similar body size were placed together in the same container, one isopod seems not to mind the intrusions of the others; group of two or three were observed feeding at a single locus and in such instances the animals will jerk only when crowding occurred.

These observations clearly demonstrate that *I. baltica* is an omnivorous species and food preference is dependent on the availability of food in its habitat. This is in contrast to the observations of previous workers which indicated that the idoteids are mainly carnivores (ROUX, 1829 and COLLINGE, 1917) or solely herbivores (BATE and WESTWOOD, 1868).

Figures obtained from estimation of rate and amount of feeding suggest an initial rapid rate of feeding which slowed down considerably within the 24-hour experiment. This feeding pattern is approximately the same for either plant or animal food. There is, however, definite discrimination in the quality of food chosen. Feeding on epiphytes, "Aufwuchs", and the filiform processes

of *Fucus* implies preference for softer, more tender plant tissue. There is an apparent desire and need for animal food since cannibalism frequently occurred among groups of idoteids isolated and fed solely on algae.

In nature, the idoteids are likely not to have regular feeding time. The alga *Fucus* provides *Idothea* a place for anchorage and insures the animal constant supply of food.

Summary

1. *Idothea baltica* (PALLAS) is an omnivore species feeding on whatever is available in the environment. There appears to be no obvious preference for either animal or plant food.

2. Rate and amount of feeding is appreciable; results on plant and animal food consumptions are discussed.

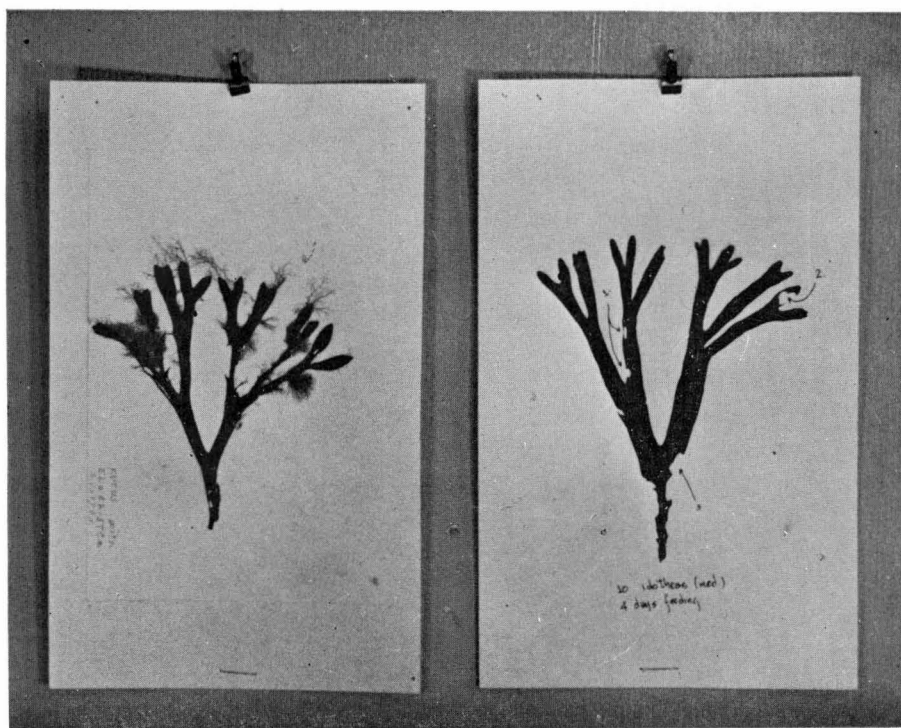
3. The association of idoteids with the benthic alga *Fucus* in the tidal rocky shores is interpreted in terms of habitat need and food demand.

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EXPLANATION OF PLATE X

Photograph shows uncleaned thallus of *Fucus* with epiphytes (before feeding experiment) at the left and cleaned thallus partly consumed by *Idothea baltica* at right (arrows point to damaged portions).



ARMANDO A. DE LA CRUZ: FEEDING ACTIVITY OF *IDOTHEA BALTICA* (PALLAS).